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Record of Decision:

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RECORD OF DECISION OPERABLE UNIT 3 BAY DRUMS SOURCE CONTROL

PEAK OIL/BAY DRUMS SITE

Brandon, Hillsborough County, Florida

Prepared By

Environmental Protection Agency

Region IV

Atlanta, Georgia

RECORD OF DECISION
BAY DRUMS SOURCE CONTROL
OPERABLE UNIT THREE
PEAK OIL/BAY DRUMS NPL SITE

I. DECLARATION

SITE NAME AND LOCATION

Peak Oil/Bay Drums Site
Brandon, Hillsborough County, Florida

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for Operable Unit Three at the Peak Oil/Bay Drums site in Brandon, Hillsborough County, Florida, which was chosen in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record for the site.

The State of Florida, as represented by the Florida Department of Environmental Regulation (FDER), has been the support agency during the Remedial Investigation and Feasibility Study process for the Peak Oil/Bay Drums site. In accordance with 40 CFR 300.430, as the support agency, FDER has provided input during this process. Based upon comments received from FDER, it is expected that concurrence will be forthcoming; however, a formal letter of concurrence has not yet been received.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

The Peak Oil and Bay Drums sites were ranked on the National Priorities List (NPL) as one site because of their close proximity and indiscriminate waste disposal practices which resulted in the contamination of adjacent surface water and groundwater. The remedy selected by EPA for the Peak Oil/Bay Drums site will be conducted in four separate phases, known as operable units.

Operable Unit One will address the source of contamination at the Peak Oil site. Operable Unit Two will address the appropriate remediation for thegroundwater at both the Peak Oil and Bay Drums sites. Operable Unit Three, presented in this Record of Decision, will address the source of contamination at the Bay Drums site, which constitutes a principal threat. Finally, Operable Unit Four will address the appropriate remediation for the wetlands surrounding the Peak Oil, Bay Drums, and Reeves Southeastern sites.

The response action selected in this ROD addresses the principal threats posed by Bay Drums site soils and sediments. The selected remedy for Operable Unit Three consists of the following major components:

- Dredge contaminated sediments which exceed performance standards from the pond areas and north drainage ditch and treat in an on-site stabilization/solidification treatment process;

- Excavate contaminated soils which exceed performance standards and treat in an on-site stabilization/solidification treatment process;

- Backfill excavated areas and surface ponds with clean fill;

- Dispose of treated soils and sediments on-site above the water table;

- Construct a low permeability clay cap over stabilized material;

- Demolish/dismantle all on-site structures and dispose in an appropriately permitted off-site landfill;

- Dispose of non-hazardous debris present at the site in an appropriately permitted off-site landfill;

- Dispose of shingle debris (known as the On-site Shingles) in accordance with all applicable Federal, State, and local requirements;

- Construct drainage ditches as needed to prevent ponding of water on the site;

- Place 1 foot of topsoil over remaining portions of the site and revegetate the site with native grasses to prevent erosion of the cap and backfilled areas.

- Conduct groundwater monitoring on a periodic basis in conjunction with groundwater treatment to assess contaminant migration;

- Erect an eight-foot security fence with appropriately spaced warning signs to prevent entry;

- Record deed notices with Hillsborough County advising that hazardous constituents are disposed on-site;

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are legally applicable or relevant and appropriate to the remedial action, and is cost-effective. This remedy utilizes permanent solutions and alternative treatment
technologies to the maximum extent practicable and satisfies the statutory preference for

remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element.

Because this remedy will result in hazardous substances remaining on-site, a review will be conducted within five years after commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

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II. DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

The Bay Drums site is located on State Road 574 (S.R. 574) east of Tampa, Florida in the unincorporated community of Brandon, Florida. A general site location map is presented in Figure 1. Specifically, the site is situated approximately 1/4 mile west of Faulkenburg Road) Figure 2).

The 14.8 acre site is bounded on the north by the Seaboard Coastline Railroad right-of-way, on the east by an abandoned railroad spur line, on the south by a wetland area, and on the west by a Tampa Electric Company (TECO) easement. Immediately east of the railroad spur line lies the Peak
Oil site with which the Bay Drums site was co-ranked on the National Priorities List (NPL). Located directly across S.R. 574 is the Reeves Southeastern Galvanizing Plant NPL site, and located east of the Peak Oil site is the Reeves Southeastern Wire property. A generalized layout of the Bay Drums site is provided in Figure 3.

The Bay Drums site is a former drum reconditioning facility. Although the facility is no longer operational, when the Bay Drums site was active, drum reconditioning occurred within the buildings on the eastern portion of the site, and drums were often stored beneath the power lines and west to a vacant lot. In the past, nearly all of the site property was used for drum storage, although the active drum reconditioning area only covered approximately 2 acres in the northeast corner of the site (see Figure 3).

Prior to development in 1962, this site consisted of an open field sparsely populated with small trees, with an approximately one-acre wetland on the eastern portion of the site. This wetland drained into a somewhat larger (approximately 5 acre) wetland about 300 feet to the southwest. Currently, surface drainage on the northern portion of the site is north to a ditch along the southern edge of the Seaboard Coastline Railroad, and the ditch then flows west. The southern portion of the site drains to the wetland area south of the site. The larger wetland (known as the "central wetland") has no surficial outlet. This wetland, which was formerly distinct from the site, is presently connected hydrologically above ground with the Bay Drums pond, which is the southern tip of the original on-site wetland.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

Bay Drums Inc. was incorporated on September 26, 1962. Few details are known of the early days of the operation. Examination of aerial photographs dated October 27, 1965 shows that a berm was constructed across the southern portion of the site, crossing the southern one-third of the on-site wetland. No standing water was visible south of the berm.

Aerial photographs of the site illustrate a surface drainage connection between the Peak Oil site and the remainder of the wetland on the Bay Drums site, north of the berm. Two possible routes are seen in the photographs for the discharge of wastes from the Bay Drums site: the drainage ditch north of the site, and the remaining wetland east of the drum reconditioning area and north of the berm. On an aerial photograph dated January 21, 1968, it was noted that the wetland remaining on the Bay Drums site had changed color, indicating a possible discharge of waste. In March 1968, this wetland was sold to Benny and Lenore Genuardi (former owners of Bay Drums).

From March 1974 to April 1978, the site was operated under different ownership as Tampa Steel Drum. An aerial photograph dated March 6, 1975 shows drums located in and along the western edge of the wetland, again indicating that this area received waste material from the site. An

aerial
photograph dated November 27, 1977 shows significant changes in the site. The wetland which had presumably been receiving wastes had been backfilled, possibly with material excavated from the southeast corner of the site where a new pond is visible (termed in this document the "backfill pond"; the original on-site wetland north of the berm is termed the "backfilled" wetland). The berm is no longer visible, and the southern tip of the original wetland south of the berm (now termed the "Bay Drums pond") appears dry. The drainage from the Peak Oil Site had been re-routed to the central wetland via an open ditch which was still visible during a reconnaissance of the site performed in February 1988.

Bay Drums, Inc. resumed operations in 1978 after Tampa Steel Drum went out of business. Aerial photography dated September 2, 1982 shows a new pond constructed in the western portion of the original wetland (backfilled wetland). This pond (the "washwater holding pond" or, "holding pond") is known to have received wastes from the drum reconditioning activities, but its date of construction is unknown. Drum reconditioning activities ceased sometime between 1982 and 1984. In 1984, the Peak Oil and Bay Drums sites were evaluated according to the Hazard Ranking System and proposed on the NPL with a score of 58.15. These sites were ranked on the NPL as one Superfund site due to their close proximity and indiscriminate waste disposal practices which resulted in the contamination of adjacent surface water and groundwater.

Between 1984 and 1986, the Bay Drums site was operated by Resource Recovery Associates, Inc. During this time, waste roofing shingles were dumped on the ground throughout most of the site to heights ranging from three to nineteen feet. The stated intent of the company was to recycle the shingles as asphalt, but no significant recycling ever occurred, and the site essentially operated as an unpermitted dump. On November 12, 1986, EPA issued a CERCLA Section 106 Order to the site operator requiring him to cease bringing materials on-site and to remove materials already located on the site. Although the owner ceased disposal operations, he failed to remove the large amount of shingles already on the site. EPA later conducted a fund-financed removal in 1989 toremove approximately 70,000 cubic yards of shingles from the site prior to beginning field activities. Following the segregation of drums and other waste material from the shingles, the shingles were placed on Hillsborough County property adjacent to the site, and a fence and warning signs were erected around the shingles. These shingles are referred to in this ROD as the Shingle Pile. These actions were necessary in order to evaluate the extent of soil contamination at the site.

An estimated 27,000 cubic yards of shingles were left on-site because a temporarily high water table made it difficult to remove these materials without also removing contaminated soils from the site. Some of these materials have been pushed into three small piles on the west side of the site (known as shingle piles 1, 2, and 3 for sampling and risk assessment purposes), but the remaining shingles are present in various areas of the site at depths of 6 to 12 inches. All of these shingles are referred to collectively in this ROD as the On-site Shingles.

Sampling conducted in 1989 revealed the presence of buried drums and sludges, which were later found to be located throughout the entire northeast corner of the site. Additionally, three other drum burial areas were discovered south of the site buildings on Hillsborough County property. Later that year, EPA removed drums, soils, and sludges contaminated with volatile and semi-volatile organic compounds, pesticides, PCBs, and metals from the site. The drums were decontaminated and disposed off-site, while approximately 4,000 cubic yards of soils and other materials were temporarily stored in a lined and covered cell which EPA built on-site. In early 1990, EPA shipped these contaminated materials by rail to a regulated hazardous waste disposal facility in Utah.

Between 1990 and 1992, EPA conducted an RI/FS in order to further define site contamination, determine risks from exposure to contaminants, and evaluate cleanup alternatives to eliminate or

reduce site risks. The final RI Report was published in July 1992, and the FS Report was completed in September 1992.

To date, EPA has identified approximately 400 companies who arranged to have drums reconditioned by or sold to Bay Drums Company and/or Tampa Steel Drums Company. Between 1986 and 1991, EPA issued notice letters to these potentially responsible parties (PRPs) advising them of their potential liability. Although the PRPs did not agree to conduct the RI/FS for the site, a group of approximately 60 of these companies has formed a steering committee for the purposes of negotiating a settlement with EPA for the final cleanup at the site.

3.0 HIGHLIGHTS OF COMMUNITY PARTICIPATION

In accordance with Sections 113 and 117 of CERCLA, EPA has conducted community relations activities at the Bay Drums site to ensure that the public remains informed concerning activities at the site. During removal activities at the site, EPA issued press releases to keep the public informed. There was some local press coverage of EPA's activities, and EPA held meetings with county and state officials to advise them of the progress at the site.

A community relations plan (CRP) was developed in 1988 and revised in 1989 to establish EPA's plan for community participation during remedial activities. Following completion of the RI/FS, a Proposed Plan fact sheet was mailed to local residents and public officials in August 1992. The fact sheet detailed EPA's preferred alternative for addressing the source of contamination (Operable Unit Three) at the Bay Drums site. Additionally, an Administrative Record for the site, which contains site related documents including the RI and FS reports and the Proposed Plan for Operable Unit Three, was made available for public review at the information repository in the Brandon Public Library. A notice of the availability of this Administrative Record for the Bay Drums site was published in the Tampa Tribune on August 11, 1992 and again on August 17, 1992.

A 30-day public comment period was held from August 13, 1992 to September 13, 1992 to solicit public input on EPA's preferred alternative for Operable Unit Three. Finally, EPA held a public meeting on August 18, 1992 at the Hillsborough Community College to discuss the remedial alternatives under consideration and to answer any questions concerning the Proposed Plan for the site. EPA's response to each of the comments received at the public meeting or during the public comment period is presented in the Responsiveness Summary in Section III of this ROD.

This decision document presents the selected remedial action for contaminated soils and sediments at the Bay Drums site in Brandon, Florida, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP. This decision is based on the Administrative Record for Operable Unit Three at the site.

4.0 SCOPE AND ROLE OF OPERABLE UNIT

As with many Superfund sites, the problems at the Peak Oil/Bay Drums site are complex. This complexity stems in part from the various media which are contaminated and from the proximity of the Bay Drums site to the Peak Oil and Reeves Superfund sites. As a result, EPA organized the remedial action at the Peak Oil/Bay Drums site into the four operable units (OUs) listed below:

- OU One: Contamination in the soils and sediments at the Peak Oil site.
- OU Two: Contamination in the groundwater at the Peak Oil and Bay Drums sites.
- OU Three: Contamination in the soils and sediments at the Bay Drums site.

. OU Four: Contamination in the wetlands surrounding the Peak Oil, Bay Drums, and Reeves Southeastern sites

Since contaminants of concern and other site conditions vary between the sites, different remedial actions to address source contamination problems (soil and sediment) were potentially necessary for each. For this reason, a separate RI/FS and ROD has been completed for addressing source problems at each of the three sites. However, EPA elected to combine the evaluation and remediation of wetlands and groundwater problems in the vicinity of the three sites since the remediation of these media at any one of the sites would potentially impact the other two sites.

In 1989, a group of PRPs for the Peak Oil site, along with the Reeves Southeastern Corporation, signed an administrative consent order in which they agreed to conduct an Area-Wide Groundwater RI/FS. EPA is currently preparing a ROD which contains a comprehensive remediation plan for addressing groundwater contamination at the Peak Oil and Bay Drums sites. A separate ROD is being developed to address groundwater contamination at the Reeves site. Wetlands problems will be addressed in a subsequent ROD.

The principal threats to human health and the environment addressed by the Operable Unit Three ROD are associated with current worker exposure to contaminated soils and sediments at the Bay Drums site.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 General Site Characteristics

The climate in the Tampa area is characterized by mild winters and relatively long, humid, and warm summers. Spring and fall tend to be dry, with the majority of the rainfall falling in the summer. The general topography of the area is flat, with an average surface elevation at the site of 37 feet above mean sea level (MSL). Elevations in areas surrounding the site range from about 25 to 45 feet above MSL. Due to the site's elevation above MSL, tidal surges are not likely to impact the area.

The Bay Drums site has several small ponds, and a ditch runs along the northern side of the site. Three wetlands areas exist near the site and are the subject of a separate Area-Wide Wetlands Impact Investigation by EPA. The wetlands are identified as the North, Central, and South Wetlands based on their orientation to the three Superfund sites. The southern portion of the Bay Drums site slopes gradually to the south and southwest toward the Central Wetland.

Land use in the area is either industrial or undeveloped, with the nearest single family residential area being 0.4 miles east of the Bay Drums facility. It is anticipated that the primarily industrial character of the area surrounding the site will be maintained in the future.

The groundwater system beneath the area consists of two major water bearing units: an upper aquifer referred to as the surficial aquifer, and the Floridan aquifer system. The surficial aquifer is from 9 feet to 37 feet thick with a saturated thickness of about 5 to 25 feet. It is separated from the Floridan aquifer by the Hawthorne formation, a low-permeability clay layer ranging from 15 to 40 feet thick. The surficial aquifer is hydraulically connected to surface waters (wetlands and streams), and the flow direction varies seasonally. Water levels also fluctuate seasonally and change rapidly in response to rainfall and other natural influences.

As shown in Figure 4, the Suwannee Limestone formation and the overlying Tampa Limestone formation comprise the upper portion of the Upper Floridan aquifer. Although regionally the Floridan aquifer flows to the southwest, in the site vicinity the flow direction shifts to the

northwest, possibly due to the proximity of the site to the Tampa Bypass Canal, which reportedly cuts into the low-permeability layer and reaches the upper Floridan aquifer in several places. The potentiometric surface of the upper Floridan aquifer is illustrated in Figure 5.

5.2 Results of Site Source Investigations

5.2.1 Previous Site Investigations

In February 1983, the Florida Department of Environmental Regulation (FDER) conducted a sampling investigation at the site. Water samples were collected from the washwater holding pond, the on-site production well, and the discharge from the holding pond. Analytical results identified the presence of heavy metals, volatile organic compounds, and petroleum hydrocarbons at the site.

A more extensive investigation was conducted by EPA in September 1983 during which samples were collected from surface water, sediments, soils, and groundwater at the site. The results of this investigation confirmed the results of the earlier FDER study and revealed the presence of pesticide contamination in the storage areas.

EPA conducted another investigation in February 1986. Samples collected during this investigation contained high concentrations of chlordane in surface soils, subsurface soils from the saturated zone, and sediments. Organic compounds and elevated levels of metals (including lead and chromium) were detected in groundwater at the site. Chlordane was also detected in a water sample taken from the washwater holding pond.

In an April 1988 site reconnaissance visit conducted by EPA, the volume of the shingle pile was estimated, and subsurface soils were examined for visible contamination using a hand auger. When the surface soils northwest of the washwater pond were disturbed, a strong odor of solvents was noted, indicating the presence of high concentrations of solvents.

5.2.2 Site Source Remedial Investigation

The Remedial Investigation for site source contamination was conducted by EPA between 1990 and 1992. Samples of surface water, sediment, soil, subsurface soils, and air were collected at the site to determine the nature and extent of site source contamination. A summary of the sampling results for each medium is presented in Table 1 and discussed in more detail in the following sections.

Soils

Surface and subsurface soils at the Bay Drums site are contaminated with a variety of organic compounds and metals. Lead was detected in both surface and subsurface soils throughout the site. As indicated in Table 1, lead concentrations as high as 1,600 ppm were detected in surface soils (0 to 2 ft. below land surface). Lead was detected in subsurface soil samples at concentrations as high as 2,500 ppm. Other metals such as chromium, zinc, barium, and arsenic were also detected frequently in certain areas of the site, but none of these were detected above remedial action objectives (RAOs).

The pesticides which were most frequently detected in site soils included DDE, ethion, and chlordane. Of these contaminants, only chlordane exceeded RAOs for the site. It should be noted that the chlordane value for a given sample consists of the sum of the following seven chlordane constituents: gamma-chlordane, alpha-chlordane, chlordene, gamma-chlordene, alpha-chlordene, trans-nonachlor, and cis-nonachlor.

Various volatile organic compounds such as ethyl benzene, xylene, and seven carcinogenic polynuclear aromatic hydrocarbons (cPAHs) were identified in soils and are ubiquitous throughout the site. In spite of their widespread presence, none of the volatile organic compounds or cPAHs exceeded RAOs for the site.

Surface Water and Sediments

The sediments at the Bay Drums site are contaminated with heavy metals, pesticides and PCBs, extractable organic compounds (notably carcinogenic PAHs) and purgeable organic compounds. However, of these constituents, lead is the only contaminant which exceeded site-specific RAOs, with concentrations ranging up to 570 ppm. Some of the same constituents were found in surface waters at the site, but the high concentrations of these contaminants in the on-site sediments probably account for their presence in surface water samples. The sediments are likely serving as a source for the continuing release of these contaminants into the surface waters.

Air

Although no volatile organic compounds were detected above background concentrations in air samples collected at sampling locations on and around the Bay Drums site, pesticides were detected at the site after the removal of shingles. Chlordane, heptachlor, DDE, and Dieldrin were detected at levels above the background concentrations determined during the RI. Chlordane and its constituents were the pesticides detected at the highest concentrations. In some instances following removal activities, chlordane was detected in air samples and determined to be up to 1000 times the pre-shingle removal concentration. For this reason, air monitoring during remedial activities is essential to ensure that site workers are adequately protected and fugitive emissions are not released from the site.

6.0 SUMMARY OF SITE RISKS

6.1 Human Health Risks

A Baseline Risk Assessment was conducted by EPA as part of the RI to estimate the health or environmental problems that could result if the Bay Drums site were not remediated. Results are contained in Section 6 of the Final Remedial Investigation Report for the Bay Drums site. A Baseline Risk Assessment represents an evaluation of the No Action alternative, in that it identifies the risk present if no remedial action is taken. The assessment considers environmental media and exposure pathways that could result in unacceptable levels of exposure now or in the foreseeable future. Data collected and analyzed during the RI provided the basis for the risk evaluation. The risk assessment process can be divided into four components: contaminants of concern, exposure assessment, toxicity assessment, and risk characterization.

Generally, EPA evaluates site risks for all environmental media in one risk assessment and determines cumulative risk based on total exposure. However, due to the close proximity of the Bay Drum, Peak Oil, and Reeves Southeastern sites, EPA is evaluating risk posed by groundwater exposure in a separate area-wide study. Since soils and sediments evaluated in this study are a source for the groundwater contamination, the impact on groundwater is discussed briefly in this risk summary.

6.1.1 Contaminants of Concern

In general, the site contaminants which could pose a potential threat to human health are metals (arsenic, lead), pesticides (chlordane, ethion), PCBs, and polynuclear aromatic hydrocarbons (PAHs). The site media which were evaluated in the baseline risk assessment were soil (surface and subsurface), sediments, the waste pile (a temporary pile of contaminated soil and debris

created during a removal and later disposed off-site), on-site shingle piles 1, 2, and 3, and air. The risk associated with exposure to on-site surface water was not evaluated due to the low levels of contaminants in the surface water.

For all contaminants except PAHs, the surface soil exposure point concentrations were based on the mean concentration detected. However, for PAHs, which are widely distributed throughout the site, the exposure point concentration is the 95% upper confidence limit (UCL) of the arithmetic average. Based on the contaminant distribution, the exposure point concentration used for the subsurface contaminants of concern was the mean concentration detected. The sediment exposure concentration for the site water bodies represents the mean concentration detected if more than one sample was collected. If only one sample was taken, this sample data was used as the exposure point concentration. Since the air contaminant of concern, chlordane, was detected throughout the site, the exposure concentration is based on the UCL concentration. The media contaminants of concern and exposure point concentrations are contained in Table 2.

Currently, the site appears to be abandoned. Although on-site groundwater is not being used at the present time, it is classified as a Florida Class II aquifer and therefore is a viable source of groundwater for future consumption. The risks associated with exposure to groundwater are addressed in the area-wide risk assessment, although the impact of contaminant leaching from soils into groundwater was evaluated. Also, the site is located in an area which is zoned for industrial uses, and zoning changes would be necessary before development of the site for residential purposes could occur.

6.1.2 Exposure Assessment

The current potential exposure pathways include the exposure of onsite workers and a young child visitor to contaminated surface soil and air and the exposure of trespassers to contaminated surface soil, the waste pile, onsite shingle piles 1, 2, and 3, and the sediments in the site water bodies. Since shingle pile 2 contained the highest contaminant concentrations, this data was used to represent all three on-site shingle piles. Future potential exposure pathways include the exposure of a child resident to surface and subsurface soils and the exposure of a future adult worker to subsurface soil. For the subsurface pathway, the assumption was made that the subsurface soil was excavated during building construction and was available for the direct contact exposure pathway. The exposure routes evaluated are ingestion and dermal absorption resulting from direct contact with the site contaminated media and inhalation of airborne contaminants. The exposure assumptions are contained in Table 3.

6.1.3 Toxicity Assessment

Slope factors (SFs) have been developed by EPA's Carcinogenic Assessment Group for estimating lifetime cancer risks associated with exposure to potentially carcinogenic contaminants of concern. SFs, which are expressed in units of (mg/kg-day)[-1], are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risk associated with exposure at that intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the SC. Use of this approach makes underestimation of the actual cancer risk highly unlikely. Slope factors are derived from results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied. The Sfs for the carcinogenic contaminants of concern are contained in Table 4.

As an interim procedure, until more definitive Agency guidance is established, Region IV has adopted a toxicity equivalency factor (TEF) methodology for evaluating carcinogenic PAHs. This methodology is based on each compound's relative potency to the potency of benzo (a) pyrene. The

TEFs for the carcinogenic PAHs are contained in Table 4.

Reference doses (RfDs) have been developed by EPA for indicating the potential for adverse health effects from exposure to contaminants of concern exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of contaminants of concern from environmental media (e.g. the amount of a contaminant of concern ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (to account for the use of animal data to predict effects on humans). The RfDs for the noncarcinogenic contaminants of concern are contained in Table 4.

6.1.4 Risk Characterization

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. Excess lifetime cancer risk is calculated from the following equation:

Risk = CDI x SC

where: risk = a unitless probability of an individual developing cancer
CDI = chronic daily intake averaged over 70 years (mg/kg-day)
SC = slope-factor, expressed as (mg/kg-day)[-1].

Table 2
Exposure Point Concentration

Chemical	Concentration	
	Soil (Surface and Subsurface) (mg/kg)	
	Surface	Subsurface
Arsenic	13	7
Chlordane	6.2	NA
Ethion	5	NA
Lead	704	809
Carcinogenic PAHs[a]	16.7	6
PCBs	18	NA
	Sediment (mg/kg)	
	North Drainage Ditch	Removal Pond No. 2
Carcinogenic PAHs[a]	4.8	13.2
	Removal Pond No. 5	Removal Pond No. 6
Arsenic	NA	59
Carcinogenic PAHs[a]	14.3	NA
Zinc	NA	490
	Hotspot (mg/kg)	
	Shingle Pile 2	Waste Pile
Chlordane	NA	24.3
Carcinogenic PAHs[a]	626	36.4
	Air (ug/cubic meter)	
Chlordane	0.89	

<Footnote>
NA Indicates that these chemicals were carried through the risk assessment but did not produce risks at levels of concern.
a The carcinogenic PAH data consists of the data for benzo(a)anthracene, chrysene, benzo(a)pyrene, dibenzo(a,h)anthracene, benzo(b and/or k)fluoranthene and indeno(1,2,3-c,d)pyrene. The concentration accounts for the relative potency of benzo(a)pyrene.
</footnote>

Table 3
Exposure Assumptions for Soil, Sediment, and Air Pathways

Parameter	Adult Worker	Trespasser
Ingestion Rate (mg/event)	50	100
Exposure Frequency (dy/yr)	250	80[a]
Exposure Duration (yr)	30	9
Body Weight (kg)	70	35
Exposed Skin Area (cm[2])	2300	2500
Adherence Factor (mg/cm[2])	0.2	0.2
Absorption Rate (metals) (%)	0.1	0.1
Absorption Rate (organics) (%)	1	1
Inhalation Rate (m[3]/hr)	0.83	0.29
Exposure Time (hr/dy)	8	4

Parameter	Child Visitor	Child Resident
Ingestion Rate (mg/event)	200	200
Exposure Frequency (dy/yr)	100	280
Exposure Duration (yr)	5	5
Body Weight (kg)	16	16
Exposed Skin Area (cm[2])	2300	2500
Adherence Factor (mg/cm[2])	0.2	0.2
Absorption Rate (metals) (%)	0.1	0.1
Absorption Rate (organics) (%)	1	1
Inhalation Rate (m[3]/hr)	0.29	0.29
Exposure Time (hr/dy)	8	24

<Footnote>
a The exposure frequency for trespasser exposure to sediments is 30 dy/yr.
</footnote>

Table 4
Toxicity Values for Contaminants of Concern

Carcinogenic Slope Factors

Chemical	Slope Factor (mg/kg-dy)[-1]	Weight of Evidence	Source
Arsenic	1.8	A	IRIS
Chlordane	1.3	B2	IRIS
Benzo(a)pyrene[a]	5.8	B2	ECAO
PCBs	7.7	B2	IRIS

Reference Doses (RfDs)

Chemical	Reference Dose (mg/kg-dy)	Critical Effect	Source
Arsenic	3E-04	Keratosis	IRIS
Chlordane	6E-05	Liver Hypertrophy	IRIS
Ethion	5E-04	Plasma Cholinesterase Inhibition	IRIS

<Footnote>
a The toxicity equivalency factors (TEFs) used to evaluate the carcinogenic PAHs are:

Compound	TEF
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1.0
Benzo(b)fluoranthene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenzo(a,h)anthracene	1.0
Indeno(1,2,3-c,d)pyrene	0.1

IRIS = Integrated Risk Management System
ECAO = Environmental Criteria and Assessment Office
</footnote>

These risks are probabilities that are generally expressed in scientific notation (e.g. 1x10[-6]). An excess lifetime cancer risk of 1x10[6] indicates that an individual has an additional 1 in 1,000,000 chance of developing cancer as a result of site-related exposure to a carcinogen over a 70 year lifetime under the specific exposure conditions at a site. A summary of the potential current and future carcinogenic risks are contained in Tables 5 and 6.

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g. lifetime) with a reference dose derived for a similar exposure period. The ratio of exposure to toxicity is called a hazard quotient (HQ). The hazard index (HI) can be generated by adding the HQs for all contaminants of concern that affect the same target organ (e.g. liver) within a medium or across all media to which a given population may reasonably be exposed. The HQ is calculated below:

Noncancer HQ = CDI/RfD

where: CDI = chronic daily intake
RfD = reference dose

CDI and RfD are expressed in the same units (mg/kg-day) and represent the same exposure period (i.e., chronic, subchronic, or short-term).

A summary of the potential current and future Hqs is presented in Table 7. This table contains risk information for chemicals and/or pathways which have individual or cumulative Hqs which exceed 0.1.

Soil and Sediment Risks

For current use, risk levels from carcinogenic contaminants of concern in soil, sediment and air do not exceed the acceptable risk range. The highest current risk level, 4x10[-5] was for an adult on-site worker. The His for non-cancer risks did not exceed 1 for any current use exposure pathways. Sediment exposure did not exceed either the risk range or an HI of 1. The risk to a potential trespasser exposed to shingle pile 2 (1x10[-4]) is at the upper end of the acceptable risk range. Exposure to airborne pesticides are within the protective range for both adult workers and child visitors.

For future use scenarios, the highest cancer risk (9x10[-5]) is associated with a child resident having direct contact with the site soils. Exposure to subsurface soils brought to the surface by excavation and construction activities would not result in risks for future residents or workers exceeding the target risk range. Although future noncancer risks (HQs) for individual pathways do not exceed 1.0, the cumulative noncancer risk (HI) is 1.0 for a future residential exposure to surface soil, indicating that a future child resident may experience non-carcinogenic toxic effects as a result of exposure to site surface soils.

Table 5
Summary of Current Site Carcinogenic Risks[a]

Surface Soil - Direct Contact

Chemical	Adult Worker	Young Child Visitor	Teenage Trespasser
Arsenic	2E-6	2E-6	3E-7
Chlordane	1E-6	1E-6	2E-7
PCBs	1E-6	2E-6	3E-7
PAHs	3E-5	3E-5	5E-6
Cumulative	4E-5	3E-5	6E-6

Sediment - Direct Contact (Trespasser)

Chemical	North Drainage Ditch	Pond 2	Pond 5	Pond 6
Arsenic	NA	NA	NA	3E-6
PAHs	1E-6	3E-6	3E-6	NA

Hotspot - Direct Contact (Trespasser)

Chemical	Shingle Pile 2	Waste Pile
Chlordane	NA	1E-6
PAHs	1E-4	1E-6

Air - Inhalation

Chemical	Adult Worker	Yound Child Visitor	Teenage Trespasser
Chlordane	2E-5	4E-6	7E-7

<Footnotes>
a A cumulative receptor risk can be obtained by summing the risks obtained from each exposure route for an individual receptor.

NA Indicates that chemicals were carried through the risk assessment but did not produce risks at levels of concern.
</footnotes>

Table 6
Summary of Future Site Carcinogenic Risks

Surface Soil - Direct Contact

Chemical	Child Resident
Arsenic	5E-6
Chlordane	3E-6
PCBs	4E-6
PAHs	8E-5
Cumulative	9E-5

Subsurface Soil - Direct Contact

Chemical	Child Resident	Adult Worker
Arsenic	2E-6	3E-7
PAHs	2E-5	3E-6
Cumulative	2E-5	4E-6

Table 7
Summary of Hazard Quotients[a]

Current Scenarios (Direct Contact)

Chemical	Child Visitor
Arsenic	6E-2
Chlordane	2E-1
Ethion	5E-2
Cumulative	3E-1

	Teenage Trespasser	
Chemical	Pond 6	Waste Pile
Arsenic	3E-2	NA
Chlordane	NA	1E-1
Ethion	2E-2	NA
Zinc	4E-2	NA
Cumulative	1E-1	1E-1

Future Scenarios (Direct Contact)

Chemical	Child Resident (Surface)	Child Resident (Subsurface)
Arsenic	2E-1	4E-2
Chlordane	6E-1	1E-1
Ethion	1E-1	1E-2
Lead[b]		
Cumulative	1E+0	2E-1

<Footnotes>
a The hazard quotients are summarized in this table for which the cumulative hazard index is equal to or greater than 0.1.

b The lead biokinetic model indicates that the blood lead level will exceed the Agency benchmark of 10 ug/dl, in 24% of the potential future residential population exposed to surface soil and 37% of the future population potentially exposed to subsurface soil.

NA Notation indicates that chemicals were carried through the risk assessment but did not produce risks at levels of concern.
</footnotes>

The lead uptake/biokinetic model was used to estimate the effect on the blood lead level of a future young child (0-5 years) resident resulting from exposure to the surface and subsurface soil mean lead concentration in contaminated portions of the site. The model predicts that the blood lead level will exceed the Agency benchmark level of 10 ug/dl in 24% of the child residential population exposed to surface soil and in 37% of the child residential population exposed to subsurface soil.

To address the risks presented above, EPA calculated potential Remedial Action Objectives (RAOs) which result in risks of 10[-4], 10[-5], and 10[6], and an HI of 1.0. RAOs were calculated for the current on-site worker and the future child resident scenarios. Based on the current industrial zoning of the Bay Drums site area and the unlikely scenario of the site being rezoned residential, RAOs relating to cancer risk of 10[-4] and a noncancer HI equal to 1.0 for a current worker were used to identify the risk-based performance standards for soils and sediments at the site.

Groundwater Risks

The area-wide groundwater risk assessment did not address current exposure since on-site groundwater is not currently being used. However, the risks associated with possible future exposure for workers or residents exceeds the risk range for both the shallow aquifer and the deeper Floridan Aquifer, which is the current source of municipal water supplies in the area. For this reason, actual or threatened releases of hazardous substances from the site soils and sediments into the groundwater, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to the public health, welfare, or the environment. The endangerment is a result of the potential for further degradation of the area-wide groundwater via leaching of contaminants from the contaminated site soils and sediments.

To address this concern, RAOs for soils and sediments that are protective of groundwater were developed for those contaminants at the site which were present in both soil and groundwater. Straight partitioning and the SUMMERS model were used to develop groundwater protection action levels for five contaminants, including ethyl benzene, toluene, xylene, naphthalene, and lead. Of these constituents, lead was the only one which exceeded its groundwater protection remedial action objective of 284 ppm.

6.1.5 Uncertainties in Risk Assessment

The evaluation of risks at a site depends on the development of a number of site-specific assumptions and the use of experimentally-derived chemical toxicity information. These assumptions and experimental data introduce a small degree of uncertainty into site risk assessments. The most significant uncertainty in this assessment is probably associated with the toxicity assessment for carcinogenic PAHs and arsenic. Historically, the Agency has evaluated the carcinogenic PAHs by summing and estimating the risk with the carcinogenic slope factor for benzo(a)pyrene (BaP). The Agency recognizes that this could be an overly conservative approach and is currently evaluating the use of relative potency factors for assessing the carcinogenic potency of these compounds relative to BaP. Region IV has adopted these potency factors because it is believed that this method gives a closer approximation of the risk associated with this class of chemicals.

The determination of the arsenic slope factor currently being used was reassessed recently by the Risk Assessment Forum and has been extensively peer reviewed. Based on this evaluation, the slope factor could be modified downward by as much as an order of magnitude. This means that the carcinogenic risks associated with presented in the Bay Drums risk assessment could be overestimated.

6.2 Environmental Risks

The environmental risks at this site were addressed in a separate study (Area-wide Wetlands Impact Study). This study evaluated the ecological status of the wetlands associated with the Bay Drum, Peak Oil and Reeves Southeastern sites. The results of this study are contained in the Areawide Wetlands Impact Study Report. The wetlands associated with these three sites will be addressed in a separate operable unit ROD.

7.0 DESCRIPTION OF ALTERNATIVES

A Feasibility Study (FS) was conducted to develop and evaluate alternatives for addressing soil and sediment contamination at the Bay Drums site. In the FS, remedial alternatives were assembled from applicable remedial activities known as process options. These alternatives were initially evaluated for effectiveness, implementability, and cost. Based on this screening, five alternatives were retained for evaluation against the nine criteria prescribed by the NCP. Included among the remedial alternatives is the no action alternative, which is required by the NCP to serve as a basis for comparison for the other alternatives.

The alternatives considered for addressing soil and sediment contamination at the Bay Drums site include the following:

Alternative 1 - No Action
Alternative 2 - Containment
Alternative 3 - In-Situ Stabilization/Solidification
Alternative 4 - Ex-Situ Stabilization/Solidification and On-Site Disposal
Alternative 5 - Ex-Situ Stabilization/Solidification and Off-Site Disposal

A number of process options are common to all alternatives except Alternative 1. These activities are described below:

- Conduct groundwater monitoring on a periodic basis in conjunction with groundwater remediation to assess remedial action performance and contaminant migration.

- Conduct perimeter and work zone air monitoring during remedial action activities to ensure worker safety and prevent off-site emissions.

- Demolish, dismantle, and decontaminate all on-site structures and dispose in an appropriately permitted off-site landfill.

- Dispose of an estimated 5,000 cubic yards of nonhazardous debris in an appropriately permitted off-site landfill.

- Dispose of approximately 27,000 cubic yards of shingle debris (known as the On-site Shingles) in accordance with all applicable Federal, State, and local requirements.

- Dredge approximately 1,500 cubic yards of sediments from the pond areas and north drainage ditch and consolidate these sediments onto another contaminated area of the site.

- Dewater and backfill the pond areas with clean fill material.

- Construct drainage ditches as needed to prevent ponding of water on the site.

- Place 4 inches of topsoil over remaining portions of the site and revegetate the site with native grasses to prevent erosion.

7.1 Alternative 1 - No Action

In the No Action alternative, no remedial action would be taken at the Bay Drums site. While EPA guidance allows the inclusion of environmental monitoring in this alternative, no measures may be taken to reduce the potential for exposure through the use of institutional controls, containment, treatment, or removal of contaminated soils or sediments. As required by SARA, the no action alternative provides a baseline for comparison with other alternatives that provide a greater level of response.

The process options which comprise the No Action alternative include the following:

- Conduct groundwater monitoring on a periodic basis to assess contaminant migration.

For cost estimating purposes, groundwater monitoring is expected to occur on a semi-annual basis for a period of 30 years.

The primary applicable or relevant and appropriate requirement (ARAR) for this alternative is the treatment technique action level for lead in groundwater from the Safe Drinking Water Act (SDWA). Modeling conducted by EPA indicates that if no action is taken to treat or contain contaminated site soils, lead may continue to leach into the groundwater above the action level. For this reason, Alternative 1 does not meet ARARs.

There are no capital costs associated with the implementation of Alternative 1. However, the annual cost of groundwater sampling and analysis is estimated to be $41,000, resulting in a total net present worth cost over 30 years of approximately $640,000.

7.2 Alternative 2 - Containment

The Containment alternative would isolate approximately 16,500 cubic yards of contaminated soils and sediments, eliminating the potential for area residents and workers to be exposed to site contaminants. In addition to the elements common to all alternatives described in Section 7.0, Alternative 2 incorporates the following additional components:

- Erect an eight-foot security fence with appropriately spaced warning signs to prevent entry.

- Record deed notices with Hillsborough County advising that hazardous constituents are disposed on the site.

- Install a slurry wall around the site which would be keyed into the clay confining unit beneath the site.

- Construct a multimedia cap (as prescribed in RCRA Subtitle C) over the consolidated waste and key the cap into the slurry wall.

During installation of the slurry wall, some excess slurry may be produced. Although these residuals are not expected to be contaminated, they can be placed on a contaminated portion of the site (similar to the sediments) and contained beneath the multimedia cap.

This alternative may not meet the SDWA treatment technique action level for lead in groundwater, since elevated lead levels in soils remaining onsite may continue to leach into the groundwater. Any construction activities which disturb contaminated soils would be designed to meet the National Ambient Air Quality Standards (NAAQS) of the Clean Air Act and Florida Ambient Air Quality Standards. Finally, although the contaminants at the site are not considered to be RCRA

hazardous wastes, the RCRA Subtitle C regulations would provide minimum technology requirements for the design of the multimedia cap. In general, Alternative 2 can be designed to meet all ARARs, although monitoring must be conducted to verify that lead contamination does not continue to leach into the groundwater above the SDWA action level.

The annual operation and maintenance costs associated with Alternative 2 are estimated to be about $20,000, with monitoring continuing for a period of 30 years. The net present worth cost of this alternative is estimated to be $2,940,000.

7.3 Alternative 3 - In-Situ Stabilization/Solidification

Alternative 3 involves the in-place (in-situ) stabilization/solidification of approximately 16,500 cubic yards of lead and pesticide-contaminated soils and sediments. In addition to the elements common to all alternatives, the process options included in this remedial alternative are listed below:

- Erect an eight-foot security fence with appropriately spaced warning signs to prevent entry.

- Record deed notices with Hillsborough County advising that hazardous constituents are disposed on the site.

- Treat contaminated soils and sediments in place using a cement or pozzolan-based in-situ stabilization/solidification process.

- Construct a low permeability clay cap over stabilized areas to prevent percolation of precipitation through the stabilized material.

The in-situ stabilization/solidification process would result in treated materials remaining within the saturated zone. No hazardous residuals are anticipated to result from implementation of this alternative. Any excess stabilization and solidification agents may be disposed on-site beneath the low permeability cap along with the treated materials.

By stabilization and solidification of contaminated materials, this alternative can be designed to prevent leaching of contamination above the SDWA treatment technique action level for lead in groundwater. Any construction activities which disturb contaminated soils would be designed to meet the NAAQS and Florida Ambient Air Quality Standards. Additionally, real-time air monitoring would be conducted in work zones and around the site perimeter to ensure that these standards are met. Therefore, Alternative 3 can be designed to meet all ARARs.

The annual operation and maintenance costs associated with Alternative 3 are estimated to be about $20,000, with monitoring assumed to continue for a period of 30 years. The net present worth cost of this alternative is estimated to be $3,290,000.

7.4 Alternative 4 - Ex-Situ Stabilization/Solidification and On Site Disposal

This alternative involves the excavation of contaminated materials, ex-situ stabilization/ solidification, and disposal of treated material onsite above the water table. A low permeability clay cap would then be constructed to reduce rainwater infiltration through the waste. In addition to the elements common to all alternatives, Alternative 4 includes the following components:

- Erect an eight-foot security fence with appropriately spaced warning signs to prevent entry.

- Record deed notices with Hillsborough County advising that hazardous constituents are disposed on the site.

- Excavate approximately 15,000 cubic yards of contaminated soils.

- Treat contaminated soils and sediments on-site in a cement or pozzolan-based ex-situ stabilization/solidification treatment process.

- Dispose of treated soils and sediments on-site in the excavated areas above the water table.

- Construct a low permeability clay cap over these materials to prevent percolation of precipitation through the stabilized material.

No hazardous residuals are anticipated to result from implementation of this alternative. Any excess stabilization and solidification agents may be disposed on-site beneath the low permeability cap along with the treated materials.

Similar to Alternative 3, by chemical stabilization treatment and physical solidification of contaminated materials, this alternative can be designed to prevent leaching of contamination above the SDWA treatment technique action level for lead in groundwater. Construction activities which disturb contaminated soils would be designed to meet the NAAQS and Florida Ambient Air Quality Standards, and work zone and perimeter air monitoring would be conducted to ensure worker and public safety. Therefore, Alternative 4 can be designed to meet all ARARs.

The annual operation and maintenance costs associated with Alternative 4 are estimated to be about $20,000, with monitoring assumed to continue for a period of 30 years. The net present worth cost of this alternative is estimated to be $2,680,000.

7.5 Alternative 5 - Ex-Situ Stabilization/Solidification and Off Site Disposal

Alternative 5 involves many of the same elements as Alternative 4, with the exception that treated materials would be disposed in an off-site landfill rather than on-site. In addition to the elements common to all alternatives, Alternative 5 includes the following components:

- Excavate approximately 15,000 cubic yards of contaminated soils.

- Treat approximately 16,500 cubic yards of contaminated soils and sediments in an on-site cement or pozzolan-based ex-situ stabilization/solidification treatment process.

- Backfill excavated areas with clean fill.

- Dispose of treated soils and sediment in an EPA approved off-site disposal facility.

No hazardous residuals are anticipated to result from implementation of this alternative. Any excess stabilization and solidification agents may either be disposed in on-site excavations or off-site with the stabilized materials.

This alternative prevents leaching of contaminants into the groundwater above health-based standards by stabilization and solidification of contaminated materials and disposal in an off-site landfill. Construction activities which disturb contaminated soils would be designed to meet the NAAQS and Florida Ambient Air Quality Standards, and work zone and perimeter air monitoring would be conducted to ensure worker and public safety. No fencing or institution controls would be necessary since all contamination which exceeds health-based levels would be

taken to an off-site landfill. Finally, all offsite disposal activities would comply with EPA's Off-Site Policy. In summary, Alternative 5 can be designed to meet all ARARs.

The annual operation and maintenance costs associated with Alternative 5 are estimated to be about $20,000, with monitoring assumed to continue for only 5 years. The net present worth cost of this alternative is estimated to be $3,210,000.

8.0 COMPARATIVE ANALYSIS OF SOURCE CONTROL ALTERNATIVES

In this section, the performance of each alternative relative to the other alternatives will be evaluated for each of the nine criteria identified in the March 1990 version of the NCP (40 CFR Part 300.430). The criteria are listed in the NCP and discussed further in EPA's guidance for conducting Remedial Investigations and Feasibility Studies. The nine criteria are segregated into three categories. Threshold Criteria are those which dictate the minimum standards with which a remedial alternative must comply. Primary Balancing Criteria include those which are used to evaluate the effectiveness of the remedial alternatives. Finally, Modifying Criteria are those which may be used in distinguishing between equally protective alternatives. The breakdown of the nine criteria into these categories is shown below:

Threshold Criteria

- Overall Protection of Human Health and the Environment
- Compliance with ARARs

Primary Balancing Criteria

- Long-Term Effectiveness and Permanence
- Reduction of Toxicity, Mobility or Volume through Treatment
- Short-term Effectiveness
- Implementability
- Costs

Modifying Criteria

- State Acceptance
- Community Acceptance

A comparison of the remedial alternatives with respect to each of these criteria and each other is presented in the following sections. Those alternatives which fail to meet the threshold criteria of overall protection of human health and the environment and compliance with ARARs will be eliminated from further analysis. Table 8 provides a tabular summary of this analysis.

8.1 Overall Protection of Human Health and the Environment

This criterion assesses whether alternatives adequately protect human health and the environment and to what degree an alternative would eliminate, reduce, or control the risks to human health and the environment associated with the site, through treatment, engineering, or institutional controls. It is an overall assessment of protection that encompasses an assessment of other

criteria such as long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs.

All remedial alternatives except No Action are considered protective of human health and the environment. The No Action alternative allows constituents to remain on-site above health-based levels, and potential impacts to groundwater from these materials are not addressed. Since the No Action alternative does not eliminate, reduce, or control any of the exposure pathways, it is therefore not protective of human health or the environment and will not be considered further in this analysis as an option for addressing soil contamination.

Although Alternative 2 may allow the leaching of contaminants above health-based criteria to continue, the slurry wall around the site perimeter would restrict off-site migration of contaminants, thereby reducing the potential for human exposure to site-related constituents.

Alternatives 3, 4, and 5 would reduce the risk from contaminated soils by immobilizing constituents through stabilization and solidification. Alternatives 3 and 4 would also provide additional protection by containing the treated materials on-site. Finally, Alternative 5 would provide the greatest degree of protection through the secure disposal of treated materials in an off-site landfill.

8.2 Compliance with ARARs

This criterion considers whether a remedial alternative meets all Federal and State ARARs. Unless a waiver is justified, the selected remedy must comply with all chemical-specific, location-specific, or action-specific ARARs. All remaining alternatives can be designed to meet ARARs. Although Alternative 2 allows untreated contaminated media to remain on-site, this alternative prevents degradation of off-site groundwater by containing contaminated groundwater within a slurry wall. Although RCRA is not an ARAR, the multimedia cap will be designed to meet RCRA Subtitle C minimum technology requirements.

8.3 Long-Term Effectiveness and Permanence

This criterion assesses whether a remedial alternative would carry a potential, continual risk to human health and the environment after the remedial action is completed. An evaluation is made as to the magnitude of the residual risk present after the completion of the remedial actions as well as the adequacy and reliability of controls that could be implemented to monitor and manage the residual risk remaining.

Alternative 5 is considered to provide the greatest degree of long term effectiveness since the residual risk remaining at the site after implementation would be minimal. However, residual risks associated with the treated materials would be transferred to another location by off-site transport and disposal. Monitoring of the effectiveness of this alternative is likely to be limited to an initial 5-year period, after which the site may be considered for delisting from the National Priorities List (NPL) with no further monitoring.

All remaining alternatives will involve increasing degrees of residual risk and will require varying amounts of monitoring and maintenance of site conditions for some period of time. The residual risks associated with Alternatives 3 and 4 will be fairly small, since the contaminants will be immobilized through treatment and isolated through capping. These alternatives will require periodic groundwater monitoring and an initial Five Year Review to monitor the effectiveness of the remedial action, after which EPA may determine that no additional monitoring is necessary.

Alternative 2 will involve a higher degree of residual risk, since no treatment is done to

reduce toxicity, mobility, or volume. This alternative relies heavily on the continued maintenance of the multimedia cap, enforcement of institutional controls, and periodic groundwater monitoring to insure the effectiveness of the engineered containment measures.

8.4 Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion assesses the degree to which a remedial alternative, by utilizing treatment technologies, would permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances at the site. The assessment focuses on the magnitude, significance and irreversibility of treatment.

Alternative 5 provides the greatest degree of mobility reduction by stabilization/solidification of the waste and disposal in a secure off-site facility. The two on-site treatment alternatives, Alternatives 3 and 4, will reduce constituent mobility by fixing contaminants in a solidified matrix. Alternative 2 is not considered to reduce mobility since site contaminants are merely contained through the use of engineered controls.

None of the alternatives provides any reduction in the toxicity or volume of site constituents. Alternatives 3, 4, and 5 are expected to result in an increase in the total volume of contaminated media because of the addition of stabilization and solidification agents. However, no increase in the volume of constituents occurs.

8.5 Short-Term Effectiveness

This criterion assesses the degree to which human health and the environment would be impacted during the construction and implementation of the remedial alternative. The protection of workers, the community, and the surrounding environment as well as the time to achieve the remedial response objectives are considered in making this assessment.

Alternative 2 will have few short-term impacts. The construction activities associated with Alternative 2 will involve minimal disturbances of contaminated soils, although the dredging of contaminated sediments may require the use of dust and vapor controls. Depending upon the method selected for in place stabilization, Alternative 3 may result in significant dust generation during the mixing process, requiring the use of air monitoring and dust suppression measures.

Both ex-situ treatment alternatives (Alternatives 4 and 5) will involve the use of numerous pieces of heavy construction equipment and significant disturbances of contaminated soils. Therefore, careful construction staging will be necessary to provide a safe working environment. Additionally, air monitoring and dust suppression will need to be used to minimize impacts from dust generated during remedial action activities.

8.6 Implementability

This criterion assesses the technical and administrative feasibility of implementing a remedial alternative and the availability of services and materials required during implementation.

While each of the alternatives will involve some technical and/or administrative implementation issues, Alternative 4 appears to involve the least. Alternatives 2, 3, and 4 will require obtaining agreements from site owners to file deed notices to restrict site access and development.

Alternative 5, which involves the off-site transportation and disposal of stabilized materials, has a number of administrative issues which may arise during implementation. In recent years,

communities in which industrial or hazardous waste landfills are located have often resisted the importation of Superfund wastes from other communities or states. This has resulted in delays to the projects and increased costs. Additionally, extensive administrative effort must be expended to secure the appropriate transportation permits, waste codes, and manifests before taking the wastes off-site.

Finally, Alternatives 2 and 3 are the only alternatives which are expected to encounter technical implementability issues. For Alternative 2, the installation of the slurry wall in the sandy soils at the Bay Drums site may present unique difficulties in keeping the trench excavation open. For Alternative 3, underground obstructions may be encountered in performing the in-situ mixing activities which could compromise the mixing efficiency, resulting in a low-strength monolith or pockets of unstabilized soils. The remaining alternatives involve straightforward construction technologies which are not expected to present any unique technical difficulties.

8.7 Cost

This criterion assesses the capital costs, operation and maintenance costs, and total present worth analysis associated with implementing a remedial alternative. The capital costs are divided into direct costs and indirect costs. Direct capital costs include construction costs, equipment costs, and site development costs. Indirect capital costs include engineering expenses and contingency allowances. Operation and maintenance (O&M) costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action.

In accordance with EPA guidance, the estimated costs presented in the FS are expected to provide an accuracy of +50 to -30 percent (USEPA 1988). EPA's detailed cost calculations for each alternative are provided in Appendix A.

The least expensive alternative is Alternative 4 at $2.68 million, and Alternative 2 is the medium-priced alternative at $2.94 million. The remaining two alternatives, Alternatives 3 and 5, cost $3.29 million and $3.21 million, respectively, which is a price variation of less than 3 percent. The alternatives evaluated represent a difference of about 23 percent between the lowest and highest priced alternatives, providing the Agency with a range of reasonably priced alternatives from which to select the preferred remedial action for the site.

8.8 State Acceptance

This criterion assesses the technical and administrative issues and concerns the state may have regarding each of the remedial alternatives. Many of these concerns are addressed through compliance with applicable ARARs.

The State of Florida, as represented by the Florida Department of Environmental Regulation (FDER), has been the support agency during the Remedial Investigation and Feasibility Study process for the Bay Drums site. In accordance with 40 CFR 300.430, as the support agency, FDER has provided input during this process. Based upon comments received from FDER, it is expected that concurrence will be forthcoming; however, a formal letter of concurrence has not yet been received.

8.9 Community Acceptance

This criterion assesses the issues and concerns the public may have regarding each of the remedial alternatives. In order to solicit the public's input, EPA issued a Proposed Plan fact sheet in August 1992 and held a comment period from August 13 to September 12, 1992 in order to obtain the community's input. Additionally, EPA conducted a joint public meeting for the Bay

Drums, Peak Oil, and Reeves sites on August 18, 1992 in which EPA representatives presented the results of the RI/FS and discussed EPA's preferred alternative for the three sites. Only a handful of residents from the surrounding community attended the meeting.

EPA's response to the comments that were received at the public meeting and during the comment period have been summarized in the Responsiveness Summary in Section III of this ROD. While few concerns were expressed by the local community about any of the alternatives considered for the Bay Drums site, EPA is concerned that the communities surrounding the off-site disposal facilities selected in conjunction with the implementation of Alternative 5 might resist the importation of Superfund wastes into their communities. This is not a concern for the remaining alternatives, which involve primarily onsite activities.

9.0 SELECTED REMEDY

Based upon consideration of the requirements of CERCLA, the detailed analysis of remedial alternatives using the nine criteria, and public comments, EPA has selected Alternative 4 as the most appropriate remedial alternative for addressing source contamination at the Bay Drums site. The specific elements which comprise the selected remedy are discussed below.

Treatment Components

Approximately 16,500 cubic yards of contaminated soils and sediments exceeding performance standards shall be treated on-site using an ex-situ stabilization/solidification process. The stabilization/solidification process used for treating contaminated soils and sediments shall utilize a combination of Portland cement and fly ash or other pozzolans to produce a relatively high-strength, low permeability monolith. Treatability studies shall be conducted during Remedial Design to determine what impacts the presence of organics compounds and shingle fragments may have on the ability of the stabilization/solidification process to meet performance standards.

Those areas of the site which exceed performance standards based on the results of the RI are shown in Figure 6. Excavation of additional areas may be necessary based on the results of confirmational sampling conducted during the remedial design and remedial action phases. Soils shall be excavated using conventional construction equipment such as backhoes, scrapers, and dozers, and soil excavations shall be designed to prevent caving. Surface pond and ditch sediments shall either be removed with a backhoe or dredged using physical means such as a dragline. Dewatering of surface ponds may be necessary prior to removal of sediments. Excavated areas and surface ponds shall be backfilled with clean imported fill.

Containment and Disposal Components

Following stabilization/solidification, treated materials shall be disposed on-site above the water table. This shall be accomplished through placement of the stabilized materials in the former process areas from which they were excavated. Some of the treated material may be disposed below natural ground surface, provided that these materials remain above the water table during all times of the year. However, partial backfilling of excavated areas may be necessary to ensure that waste is not disposed in the saturated zone.

A low permeability surface cap (illustrated in Figure 7) shall be constructed over treated materials. This cap shall be constructed of a low permeability soil layer (approximately 2 ft. thick) with a minimum permeability of 10[-7] cm/sec and a 1 ft. topsoil layer to sustain vegetation. The area designated for treated soil disposal and capping is shown in Figure 8. Additionally, the remaining portions of the site shall be covered with 1 foot of topsoil cover to prevent runoff potentially affected by residual contamination below performance standards

from impacting wetlands near the site. Finally, the entire site shall be seeded with native grasses to prevent erosion of the cap and soil cover.

Prior to the excavation of contaminated soils, all site structures must be demolished or dismantled and decontaminated. Demolition debris shall be disposed in a non-hazardous industrial waste landfill, provided that sampling is conducted to demonstrate that the material is not hazardous. If sampling indicates that the materials are hazardous and decontamination is not possible, then the material must be disposed in a hazardous waste landfill. Other non-hazardous debris present at the site which is associated with past operations shall be disposed off-site. EPA has not quantified the amount of material requiring disposal, but for cost estimating purposes, a volume of 5,000 cubic yards of non-hazardous debris was assumed. Additionally, an estimated 27,000 cubic yards of shingle debris (known as the On-site Shingles) shall be disposed in accordance with all applicable Federal, State, and local requirements. All off-site disposal activities must comply with EPA's Revised Procedures for Implementing Off-Site Response Actions (Off-Site Policy).

The selected remedy does not address the off-site Shingle Pile on the Hillsborough County property adjacent to the Bay Drums site. EPA, the State of Florida, and Hillsborough County are currently evaluating options for addressing this material.

General Components

The entire site shall be fenced with a new eight-foot security fence topped with three strands of barbed wire. Warning signs shall be placed at appropriate intervals, indicating that hazardous substances are disposed at the site and providing EPA's phone number for information on the site. Any existing site fencing shall be removed and salvaged or disposed as non-hazardous in an off-site landfill.

During design, the impacts of construction activities on site drainage patterns shall be evaluated to determine if additional drainage ditches must be constructed. At a minimum, it is expected that a drainage ditch surrounding the surface cap will be necessary to manage drainage from the cap. In general, vegetated open trapezoidal channels will be used to accomplish this purpose. Monitoring of surface water and sediment runoff from the site shall be conducted to evaluate the effectiveness of the soil cover in preventing impacts to the wetlands. The frequency and duration of this monitoring shall be established during the Remedial Design. Deed notices shall be filed with Hillsborough County advising that hazardous substances are disposed on-site. Additionally, the notice shall restrict the use of the site to activities which do not compromise the effectiveness or integrity of the remedial action.

Finally, groundwater monitoring shall be conducted on an annual basis. In general, analyses for lead and chlordane shall be performed on samples from both the surficial and Floridan aquifers. EPA anticipates that this portion of the source control remedy will be conducted in conjunction with the area-wide groundwater remedy. EPA will conduct a formal review (Five Year Review) of the data five years after initiation of the remedial action and every five years thereafter to evaluate the effectiveness of the remedy. This review is required under Section 121 of CERCLA to assure that human health and the environment are being protected by the remedial action being implemented. Based on this review, EPA will make a determination as to whether groundwater monitoring and Five Year Reviews should continue, additional remedial action is required, or the source control remedy is operating properly. Final delisting of the site depends upon the effective operation of all operable units for the site.

ARARs Addressed by the Selected Remedy

Those ARARs which specifically relate to the selected remedy are presented below. This list is

not exhaustive, and EPA may determine that other requirements are appropriate for chemicals or conditions encountered or actions taken at the site. The major federal ARARs which shall be attained by the selected remedy are as follows:

- Safe Drinking Water Act, 40 CFR 141.11-141.16, 141.50141.51.
- RCRA Toxicity Characteristics Rule, 55 FR 11798.
- Clean Air Act, 40 CFR 50, National Ambient Air Quality Standards.
- Endangered Species Act, 50 CFR Part 402.
- National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61.240-247.

The major State ARARs which shall be met by the selected remedy are as follows:

- Florida Drinking Water Standards, FAC 17-550.
- Florida Rules on Hazardous Waste Warning Signs, FAC 17736.
- Florida Air Pollution Rules, FAC 17-2.1.
- Florida Ambient Air Quality Standards, FAC 17-2.3.

The Land Disposal Restrictions (LDRs) identified in 40 CFR 268 are not ARARs for the selected remedy for the Bay Drums site since no listed wastes are present at the site, and leaching tests conducted during the RI demonstrated that site soils were not characteristic hazardous wastes as defined in RCRA (40 CFR 261). However, the RCRA Toxicity Characteristics Rule does provide performance standards for leaching potential for lead and chlordane.

9.1 Remedial Action Objectives

As a part of the Baseline Risk Assessment presented in the RI, remedial action objectives (RAOs) for soils and sediments were determined for several exposure scenarios and various carcinogenic risk levels. Based on the industrial character of the facilities surrounding the Bay Drums site and the expectation that the area will remain industrial in the future, EPA determined that a cancer risk of 10[-4] for a current worker scenario is appropriate for the site. Based on the data collected to date, none of the carcinogenic risk levels were exceeded in the soils, sediments or surface water. Although the noncarcinogenic exposure point concentration for chlordane for the current worker scenario did not exceed the RAOs, certain hotspot areas did exceed RAOs and will require remediation. Additionally, the noncarcinogenic RAO for lead was exceeded. A summary of the RAOs for these two constituents is presented in Table 9.

RAOs for soils and sediments that are protective of groundwater were also developed for those contaminants at the site which were present in both soil and groundwater. Straight partitioning and the SUMMERS model were used to develop groundwater protection RAOs for five contaminants, including ethyl benzene, toluene, xylene, naphthalene, and lead. Of these constituents, lead was the only one which exceeded its groundwater protection RAO of 284 ppm.

9.2 Performance Standards

Based on the RAOs identified in Section 9.1, performance standards for excavation and treatment of soils and sediment were developed to protect human health, to prevent contamination of the groundwater, and to be in compliance with ARARs. Excavation and dredging shall continue until

the remaining soils and sediments are at or below the performance standards. All excavation shall comply with ARARs, and testing methods approved by EPA shall be used to determine whether the performance standards have been achieved. Based on the appropriate risk levels and groundwater protection standards for the site, the performance standards for the chemicals of concern which shall be achieved by the selected remedy are as follows:

Chemical	Performance Standards (mg/kg)
Lead	284
Chlordane	180

After the material that is contaminated above the performance standards is excavated or dredged, it is to be stabilized. Based in part on discussions with FDER and EPA technical staff and the guidelines provided in the EPA publication Stabilization/Solidification of CERCLA and RCRA Wastes (EPA/625/689/022, May 1989), EPA has determined that the following performance standards for the stabilized material shall be met:

Parameter	Performance Standard	Test Method
Permeability	10[-7] cm/sec	EPA Method 9100-SW846
Unconfined Compressive Strength	250 psi	ASTM 1633-84
Leachability	< 5 mg/l Lead < .03 mg/l Chlordane	TCLP
Leachability	10[-12] mg/l	Modified ANS 16.1

For the low permeability surface cap, the following performance standard shall apply:

Parameter	Performance Standard	Test Method
Permeability	10[-7] cm/sec	ASTM D1557 or equivalent

Because certain performance standards may not be determined until the Remedial Design phase, the list of performance standards in this section is not considered to be exhaustive and may be subject to modification by the Agency during RD/RA implementation.

10.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as their principal element. The following sections discuss how the selected remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment by immobilization of contaminants in the stabilized matrix and disposal of the matrix above the water table. Stabilization will reduce the mobility of contaminants in the soil, thereby reducing the risk associated with further degradation of on-site groundwater. Capping of the treated soils with a low contact of lead and pesticide-contaminated materials. Additionally, the topsoil and vegetated cover over the remaining portions of the site will prevent runoff potentially affected by residual contamination below performance standards from impacting adjacent wetlands. Finally, fencing and deed notices will restrict access to the site, further reducing the potential for exposure.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)

The selected remedy of excavation, stabilization/solidification, on-site disposal, and capping of contaminated soils and sediments will comply with all applicable or relevant and appropriate requirements (ARARs). The ARARs are presented below:

Chemical-Specific ARARs

- Safe Drinking Water Act, 40 CFR 141.11-141.16, 141.50141.51. Treatment technique action level for lead is relevant and appropriate in development of soil action levels which are protective of site groundwater.

- Florida Drinking Water Standards, FAC 17-550. Maximum contaminant level for lead is relevant and appropriate for development of soil action levels protective of groundwater.

- Clean Air Act, 40 CFR 50. Provides National Ambient Air Quality Standards which are relevant and appropriate to lead and particulate emissions resulting from remedial activities conducted at the site.

- Florida Ambient Air Quality Standards, FAC 17-2.3. Relevant and appropriate to remedial activities conducted at the site which may generate lead and particulate emissions.

- RCRA Toxicity Characteristics Rule, 55 FR 11798. Relevant and appropriate in providing performance standards for lead and chlordane for TCLP testing of stabilized material.

Location-Specific ARARs

- Endangered Species Act, 50 CFR Part 402. Applicable to site construction activities which may impact the critical habitat of endangered or threatened species present in the site area.

- Florida Rules on Hazardous Waste Warning Signs, FAC 17736. Identifies requirements applicable to signs around perimeter and at entrances of site.

Action-Specific ARARs

- National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR Part 61.240-247. Relevant and appropriate to the handling of asbestos-contaminated shingle debris (On-site Shingles).

- Florida Air Pollution Rules, FAC 17-2.1. Applicable to remedial activities conducted at the site which may generate air emissions.

10.3 Cost Effectiveness

EPA believes this remedy will eliminate the risks to human health at an estimated cost of $2,680,000. This alternative is the least expensive of the remaining alternatives. Even at a lower cost, the selected remedy provides an additional measure of protectiveness over Alternative 2 by providing treatment of the waste material, and it provides additional groundwater protection over Alternative 3 by ensuring the disposal of treated materials above the water table. Finally, it avoids potentially costly administrative delays which are often associated with off-site
disposal actions such as Alternative 5.

10.4 Utilization of Permanent Solutions to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the source control operable unit at the Bay Drums site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA has determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, and cost, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy will address the principal threats posed by the soils and sediments through stabilization/solidification, achieving significant reductions in the mobility of lead and chlordane. This remedy provides more or equally effective treatment as any of the alternatives considered, and it will cost less than any alternative except No Action. The treatment of the contaminated soils and sediment is consistent with program expectations that indicate that highly toxic and mobile wastes are a priority for treatment and often necessary to ensure the long-term effectiveness of a remedy.

10.5 Preference for Treatment as a Principal Element

By immobilizing the contaminants in a stabilized matrix, the selected remedy addresses one of the principal threats posed by the site through the use of treatment technologies. The threat posed by contaminated groundwater at the site will be addressed by the Area-Wide Groundwater remedy.

11.0 DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan for the Bay Drums site, which was released for public comment in August 1992, identified Alternative 4 as the preferred alternative for soil and sediment remediation. EPA reviewed all written and verbal comments submitted during the public comment period. As described in the FS, the Proposed Plan included a 4 inch topsoil cover as part of the revegetation of the site. However, based on comments received from the natural resource trustees and FDER, EPA added a requirement to increase the topsoil cover on remaining portions of the site from 4 inches to 1 foot to prevent runoff potentially affected by residual contamination below performance standards to impact adjacent wetlands. Monitoring of surface water and sediment runoff from the site will also be required to evaluate the effectiveness of the soil cover. This change will result in an estimated increase of $36,000 in the overall cost of the selected remedy. No other significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.